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CONGRESS OF PHYSICS AT PUEBLA, MEXICO

The First National Congress of Physics was held under the auspices of the Governor of the State of Puebla, the Rector of the University of Puebla, and the Director of the National Astrophysical Observatory of Tonanzintla, at Puebla City, Mexico, on May 3 to 8, inclusive.

Approximately 50 members were present, including the following from the United States who received special invitations from the President of Mexico to attend the Congress: Dr. J. G. Baker, Harvard University; Dr. J. W. Beams, University of Virginia; Dr. P. W. Bridgman, Harvard University; Dr. L. J. Briggs, National Bureau of Standards; Dr. S. Chandrasekhar, University of Chicago; Watson Davis, Science Service; Dr. W. V. Houston, University of California; Dr. L. D. Leet, Harvard University; Dr. I. I. Rabi, Columbia University; Dr. Harlow Shapley, Harvard University; Dr. W. F. G. Swann, Bartol Foundation of the Franklin Institute; and Dr. O. R. Wulf, United States Weather Bureau.

The regular sessions were held at the University, with certain special lectures at the University, and at two of the city's theaters. At the opening session, the delegates were welcomed by Dr. C. Gonzalo Bautista, Governor of the State of Puebla. After the president of the Congress, Dr. Mauel Vallarta (formerly professor at Massachusetts Institute of Technology), had taken the chair, Governor Bautista presented the Cross of Honor of the State of Puebla to Dr. Harlow Shapley, in recognition of his achievements in galactic astronomy.

In addition to five special evening conferences, seven regular sessions were held at which 45 papers were presented. Many of the visiting American scientists reviewed fields of activity with which their names are closely associated. They were later given a special audience by the President of Mexico, and many other outstanding courtesies were extended.

A most interesting feature of the Congress was a visit to the new Mexican astrophysical observatory located near Puebla, with Popocatapetl towering in the distance. Work in this observatory is devoted largely to the study of galaxies, and the observatory is equipped with a very fine Schmidt reflector for this purpose. Here also is located the new seismograph recently purchased by the Mexican Government. At present the seimological stations in

[1] Published with approval of the Director of the Budget.

our eastern States are able to get a good north-south range on seismological disturbances in the Caribbean, but an east-west range for this region has been lacking. The new seismological station will provide the much-needed intersecting range, and thus fix the center of the disturbances.

Great interest was shown by the Mexican scientists in the progress of research in the United States. In his address on the relation between the Government and scientific investigation, Dr. Briggs referred to the fact that the International Bureau of Weights and Measures at Paris is at present isolated from the republics of the world. In recognition of this condition, the Secretary of Commerce had requested him to convey the message that "the National Bureau of Standards will be most happy to carry out for the Mexican Government, and for other American republics, without cost, any comparison of your standards with our own that you may deem desirable." This invitation was the subject of much favorable comment, and a special article on the work of the National Bureau of Standards was published in one of the leading newspapers.

STATE-WIDE BUILDING CODES

In an address before the annual meeting of the Building Officials Conference of America at Richmond on May 13, George N. Thompson, chief of the Bureau's Building Codes Section, pointed out that there are nearly 2,000 local building codes that regulate the manner in which building construction may be carried on in this country. Since these codes have been adopted at different times, in many cases using different sources of information, they naturally reflect a variety of ideas as to what is proper for safeguarding occupants of buildings and the general public.

A few codes establish minimum requirements on a State-wide basis, and in such cases municipalities may adopt additional or more stringent provisions. The more general adoption of state codes would seem to offer certain advantages, including more uniform requirements bearing upon designers and manufacturers of building materials, centralized approval of new materials and methods of construction, and more prompt adoption of improvements suggested by technical research. The fact that state codes have not been more generally adopted indicates that they may be open to objections that are not immediately apparent.

Since a great deal of attention is being given to the development of improved technical requirements, it seems logical that the means through which these improvements find their way into legal application should receive at least an equal amount of thought. Accordingly, Mr. Thompson suggests that the Building Officials Conference of America should review the situation with the object of developing a clear statement of the advantages and disadvantages of State wide requirements.

EFFECT OF AERATION ON SOILS

A number of investigators have studied the change in pH value of soils in passing from the moist field condition to the air-dried state. It is evident from these studies that drying of soils is occasionally accompanied by a slight change in reaction, generally in the direction of increased acidity. Since the air-dried soil offers a more uniform basis, the soil in this condition is generally used for determining the pH value.

Samples of a poorly drained soil showed large differences in hydrogen-ion concentration between the fresh soil and the soil in the air-dried condition. By varying the degree of aeration, the soil was passed through a cycle—from neutrality, as found in the natural field condition, to high acidity, which occurs in the air-dried state. As a result, it has been concluded that pH measurements of very poorly aerated soils should be made only on samples maintained in the field condition. The change in pH value observed has been associated with the activity of sulfate-reducing bacteria.

The conclusions reached in this study, which will be reported in detail by Melvin Romanoff in a forthcoming issue of the magazine "Gas", have an important bearing on the location of soil areas which are corrosive because of the activity of sulfate-reducing organisms. As these bacteria function only within a narrow pH range, the reaction of the soil is considered to be an important criterion in identifying corrosive areas where these bacteria are active.

TRANSLATION WAVES IN OPEN CHANNELS

The general problem of the motion of waves in open channels and rivers is an exceedingly difficult one. The first ex-

perimental investigations of the laws of motion of floods were probably those of the Italian geometer Bidone, carried out in 1823. During the course of the last century these studies have continued, the experiments of Scott Russell and Bazin being classic examples. These experimental investigations were followed by the theoretical analyses of St. Venant and Boussinesq, whose papers are enlightening even today. Boussinesq's contributions, although not well known in this country, will have permanent value as hydraulic literature because of their profound reasoning and the broad scope of the subjects considered.

The engineering importance of wave phenomena in water courses is now evident, and contemporary investigations are increasing in number and breadth. The extensive development of inland navigation in Europe has caused investigators there to approach the problem in a somewhat different manner from those who have studied the subject in this country, where the emphasis is largely on protection against floods. One of the objects of a series of papers which the Bureau is publishing on the motion of flood waves is to bring together these two lines of thought. (See J. Research NBS, 24, 47 (1940) RP1272, by G. H. Keulegan and G. W. Patterson.) The present interest in wave phenomena, due to the increasing economic importance of the problems involved, has encountered certain deficiencies in hydraulic theory. Most of these difficulties arise from the fact that as yet no mathematical analysis has been devised which takes complete account of the forces of fluid resistance, which play a major role in the formation of the waves and their subsequent attenuation. Fluid resistance caused by turbulence is an inherent property of all watercourses, artificial and natural.

Engineering practice is concerned particularly with two types of wave motion. The first is encountered in the operation of locks in canals, or surges in flumes leading to or from hydroelectric stations. The second, which is more familiar, occurs in connection with the problem of flood routing. In this case, the mode of formation of the wave is not so important as its subsequent motion, and the waves have a greater duration and size. In both cases the problem to be considered is the possibility of damage resulting from the increased height and volume of the water, and occasionally, the reduced clearance under bridges. The engineer is thus interested in the mode of origin of these waves, their velocity of propagation, and their attenuation and deformation, and the purpose of both experimental and theoretical research is to provide pertinent quantitative information.

So far as the theory is concerned, no sharp line of demarcation exists between flood waves and the shorter man-made waves occurring in canals. In extreme cases, the former are said to be governed by friction, and the latter by inertia. This second case was discussed in RP1272, already referred to. A large class of phenomena of practical importance cuts across this artificial boundary, and some progress has been made in studying the motion of waves controlled both by friction and inertia. Keulegan and Patterson have devised a nathematical treatment when the effects of friction are regarded as subordinate to those of inertia, and this is the central subject of RP1544 in the June Journal of Research, which thus becomes the second publication in the wave series. The authors deal with the motion of medium-length waves, and have sought to give the complete derivation of the basic principles underlying the final results.

ULTRAVIOLET SOLAR RADIATION

Sun bathing and the resulting burns from overexposure of the untanned skin attest to the importance of reliable information on the amount of biologically effective ultraviolet radiation from the sun and from the whole sky, under various weather conditions.

For some years W. W. Coblentz and R. Stair have investigated the instruments and methods of evaluating the biologically effective component of ultraviolet solar and sky radiation useful in heliotherapy; including instruments for measuring ultraviolet radiation incident on a surface exposed normal to the sun, and instruments exposed horizontally to receive the direct solar rays and also the rays incident from the whole sky. The latter instruments are useful to meteorologists in their studies of ultraviolet climatology.

The instruments (photoelectric cells) now used in making ultraviolet radiation measurements are highly selective in their spectral response. Moreover, thus far it has been impossible to reproduce photocells having exactly

the same response, which should, preferably, cover only the biologically effective ultraviolet of wavelengths shorter than about 3200 A. It is this radiation that produces vitamin D and is effective in preventing and curing rickets; also in curing lupus and other skin diseases.

In the June Journal of Research (RP1542), measurements of ultraviolet solar radiation are given, as obtained with photocells differing widely in spectral response. If and when manufacturers succeed in making photoelectric cells in which the response range is identical, and is preferably one that coincides with the band of wavelengths that heals lupus, surgical tuberculosis and rickets; that produces vitamin D, etc., the whole procedure used in evaluating biologically effective ultraviolet solar and sky radiation will be greatly simplified.

The data in the present paper show marked variations in the spectral quality and total intensity of the biologically effective component of ultraviolet solar radiation caused by slight changes in turbidity of the atmosphere and by the well-known cyclonic and seasonal changes in ozone concentration in the stratosphere—ozone being very opaque to ultraviolet solar radiation. It is further shown that at a sea-level station in midlatitude (Washington, D. C.) on the clearest days, the ultraviolet intensity at the noon-hour in midwinter is only about one-sixth that of midsummer.

A TUNGSTEN-IN-QUARTZ LAMP, AND ITS APPLICATIONS IN PHOTOELECTRIC RADIOMETRY

A paper by R. Stair and W. O. Smith, of the Bureau of Plant Industry (RP1543), in the June Journal of Research gives constructional data of a tungsten-filament-in-quartz lamp, and discusses its applications to precision filter radiometry. The lamp is adapted for use in calibrating phototubes for spectral and total radiation sensitivity. In its applications, it supplements the spectroradiometer for calibrating phototubes, while employing the tubes with the associated filters used in measuring the radiation under investigation.

The spectral output-radiation from such a lamp depends upon the temperature of the filament, the emissivity of tungsten, and transmission of the fused-quartz envelope. A table of relative blackbody radiation intensities has been calculated for the range of temperature from 2,500° to 2,900° K in the wavelength interval 2300 to 3500 A.

THERMAL EXPANSIVITY AND DENSITY OF INDIUM

Peter Hidnert and Mary Grace Blair have investigated the linear thermal expansion of cast indium of high purity between —190° and +100° C. The following equation was derived for the linear expansion of indium:

$L_t = L_o [1 + (28.9_3 t + 0.013_4 t^2) 10^{-6}]$, where L_o represents the length of the metal at 0° C, and L_t the length at any temperature, t, within the range of the observations. The average coefficients of cubical expansion of indium were found to be 77×10^{-6} and 101×10^{-6} per degree C for the ranges 0° to 25° C and 25° to 50° C, respectively. These coefficients of cubical expansion are not equal to three times the coefficients of linear expansion for the corresponding temperature ranges, on account of the anisotropy of indium.

The density of cast indium was found to be 7.281 g/cm³ at 22.6° C. The density of indium calculated from the best available data on atomic weights and lattice constants, is 7.40 g/cm³. Observed densities at 0°, 25°, and 50° C are also given in this paper.

The complete account of this work will be published as RP1541 in the Journal of Research for June.

STANDARD SAMPLES

The sales of the Bureau's Standard Samples continue to show large gains, and in April reached the all-time high of 2,303 samples, valued at $5,675, per month. These standards find many applications in connection with the war effort for checking methods used in testing raw materials, controlling manufacturing processes, and inspecting finished products. A wide variety of samples are available, including ores, irons, steels, steel-making alloys, nonferrous metals, ceramic materials, and pure chemicals that are certified as to composition; metals of certified melting points; thermoelectric standards for calibrating thermocouples; chemicals for checking heating values; cements for checking the fineness of sieves; and sugars of saccharimetric values.

A description of the Standard Samples and a list of those available, with prices, will be furnished on request.

FLASH POINTS OF HEAVY-BODIED PAINTS

The Tagliabue (Tag) Closed Cup Method for determining flash points is prescribed in certain specifications for paints. The use of this method in tests of heavy-bodied paints, such as the camouflage paint covered by Specification T–1279 of the Corps of Engineers, U. S. Army, is open to question because no stirring device is used to maintain an even distribution of temperature, as is done in the Pensky-Martens tester.

In an article submitted for publication in American Paint Journal and in the Bulletin of the American Society for Testing Materials, David Busker reports that during tests of heavy paints at the Bureau, wide differences were noted in the results obtained with the two types of tester. In the Pensky-Martens tester, the heat was uniformly distributed throughout the paint, whereas in the Tag Closed Cup tester, the temperatures were higher at the periphery than at the central point where the thermometer is inserted, and corresponded quite closely with the flash-point temperatures indicated in the Pensky-Martens tester.

PORCELAIN ENAMELED IMMERSION-TYPE WATER HEATERS

Because of the scarcity of stainless steel and other corrosion-resistant alloys, the Quartermaster Corps of the Army has been in search of a suitable substitute material from which to make the heating "coil" for an immersion-type water heater in which the heat is supplied by a flame from a gasoline torch playing upon the inside of a tube immersed in the liquid. To assist them in selecting an enamel for this use, the Quartermaster Corps forwarded to the Bureau six sets of specimens having different types of enameled coatings with the request for appropriate tests and a report upon the relative suitability of the respective enamels.

These specimens were tested for resistance to thermal shock, for resistance to boiling tap water and to boiling 1-percent trisodium phosphate, for adherence of the enamel to the metal, and for acid resistance of the enamel. The last-named test was made with 10-percent citric acid at room temperature, first for a 15-minute period and then for a 7-hour period. As a result of these tests, an enamel was selected which was successfully quenched from a temperature of 1,000° F in cold tap water without failure, which showed little or no attack in the test with boiling tap water and boiling trisodium phosphate solution, and having fairly good acid resistance and satisfactory adhesiveness.

COMMERCIAL STANDARD FOR MINERAL WOOL

Commercial Standard CS105–43 for mineral wool, loose, granulated, or felted, for use in low-temperature installations is now available in printed form. It is designed to improve the quality of mineral wool and to set up installation requirements to be followed in insulating refrigerated compartments or cold areas.

Mineral wool is a substance composed of very fine interlaced mineral fiber, having the appearance of loose wool or cotton. It is a fibrous, glass-like material composed principally of silicates of calcium and aluminum and is manufactured from rock, slag, or glass in numerous localities throughout the United States.

This voluntary standard was proposed in April 1942 by the Industrial Mineral Wool Institute. Following several preliminary meetings, a proposed commercial standard was prepared and submitted to manufacturers and to technical, distributor, and consumer organizations for their comments. The standard was then adjusted according to the composite recommendations of those concerned and circulated to the trade for written acceptance. It covers minimum physical and chemical requirements for mineral wool, as well as for auxiliary materials used in insulating cold areas. Detailed descriptions and diagrams are included in the pamphlet to illustrate the proper way to insulate various types of construction, as well as the minimum thickness of insulation required for various operating temperatures.

Printed copies of CS105–43 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

COMMERCIAL STANDARD FOR TEXTILE PRODUCTS

Commercial Standard CS65–43, released last month, provides uniform methods for determining the fiber composition of textile products and for reporting the results of these analyses.

It is a revision of CS65–38 on wool and part wool fabrics, the labeling provisions of which were superseded by those of the Wool Products Labeling Act of 1939.

The revision was initiated by retailers and commercial textile testing laboratories to meet the need for standard methods of analyzing finished textile products of unknown or doubtful composition. The scope of the standard has been broadened to cover mixtures of cotton, rayon, silk, and woolen fiber. It now includes a method of analysis for products composed of woolen fiber and cotton, rayon, or silk; a method for products containing a mixture of two or more such fibers; and a method for determininig quantitatively the percentage of nonfibers, such as sizing and finishing materials. No distinction is made between "wool," "reworked wool," and "reused wool" for purposes of the Wool Products Labeling Act, and the provisions of the standard in no way conflict with the requirements of the Act.

Definitions of cotton, acetate rayon, regenerated cellulose rayon, silk, woolen fiber, and staple fiber are given, as well as the wording of a certificate that may be used by laboratories on their reports to inform their clients that the results were obtained by the methods outlined in the standard. The usual lists of official acceptors, members of the standing committee, and a brief history of the project are included. The effective date for analyzing and reporting was February 20, 1943.

Copies of CS65–43 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

NEW AND REVISED PUBLICATIONS ISSUED DURING MAY 1943

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 30, number 5, May 1943 (RP1537 to RP1540, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers [2]

[Reprints from the March and April 1943 Journal of Research]

RP1526. Occurrence of sucrose and inulin-hydrolyzing enzymes in commercial enzyme preparations. William Ward Pigman. Price 5 cents.

RP1527. Perforated cover plates for steel columns: Compressive properties of plates having circular perforations and a width-to-thickness ratio of 53. Ambrose H. Stang and Martin Greenspan. Price 5 cents.

RP1531. Classification of carbohydrases. William Ward Pigman. Price 5 cents.

RP1535. Sources of error in precise commercial refractometry. Leroy W. Tilton.

Simplified Practice Recommendation [2]

R8–42. Range boilers and expansion tanks. (Supersedes R8–29.) Price Price 5 cents.

Commercial Standards [2]

CS65–43. Methods of analysis and of reporting fiber composition of textile products. (Supersedes CS65–38.) Price 10 cents.

CS105–43. Mineral wool; loose, granulated, or felted form, in low-temperature installations. Price 5 cents.

Technical News Bulletin [2]

Technical News Bulletin 313, May 1943. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC721. Dampness in masonry walls above grade. (Supersedes LC514.)

LC723. Gages (dimensional): Publications by the staff of the National Bureau of Standards. (Supersedes LC439.)

LC724. Sources of information on the properties of metals and alloys. (Supersedes LC601.)

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[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and in countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS[3]

Large-deflection theory of curved sheet. Samuel Levy. NACA Tech. Note 895 (Nat. Adv. Com. Aero., Washington, D. C.) (May 1943). (Restricted distribution).

Proposed substitutes for rubber. Catherine F. Higgins. Engineering Experiment Station News (Ohio State University, Columbus, Ohio) **15**, No. 2, 11 (April 1943).

Advances in plastics during 1942. G. M. Kline. India Rubber World (386 Fourth Ave., New York, N. Y.) **107**, No. 6, 373 (March 1943).

An improved gas-expansion volumenometer. Joseph C. Richmond, John B. Peterson, and Winslow H. Herschel. J. Am. Ceramic Soc. (2525 North High St., Columbus, Ohio) **26**, No. 4, 127 (April 1, 1943).

The publications of the National Bureau of Standards. J. L. Mathusa and K. S. Gibson, Science (Science Press, Lancaster, Pa.) **97**, No. 2520, 341 (April 16, 1943).

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[3] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

U. S. GOVERNMENT PRINTING OFFICE: 1943